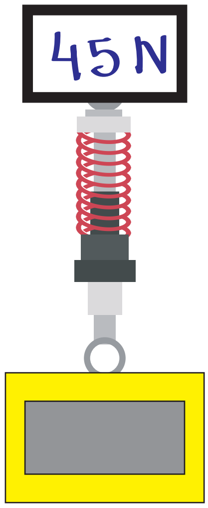
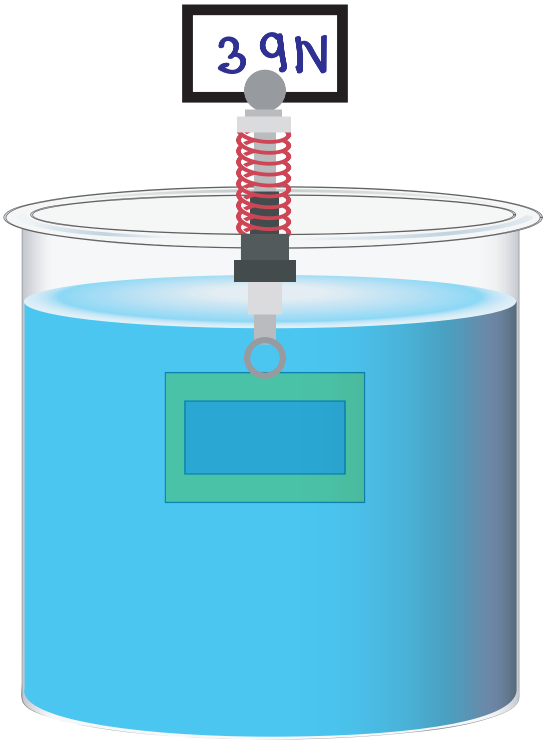
1. Un trozo de aluminio total mente cubierto con una capa de oro forma un lingote que pesa $45N$. Si el lingote se suspende de una balanza de resorte y de sumerge en agua. La lectura es de $39N$. ¿determine el peso de oro que hay en el lingote? $\rho_{Al} = 2{,}7\times10^3 \frac{kg}{m3}$, $\rho_{Au} = 19{,}3\times10^3 \frac{kg}{m3}$
Resp: $33{,}5N$



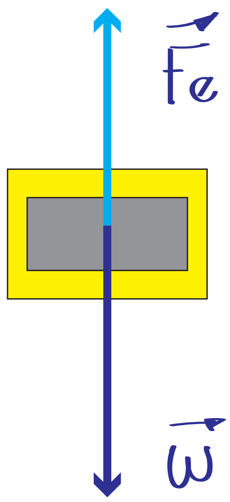


Datos

$$\rho_{Al} = 2.7 \times 10^3 \left[\frac{Kg}{m^3}\right]$$

$$\rho_{Au} = 19.3 \times 10^3 \left[\frac{Kg}{m^3}\right]$$

a)



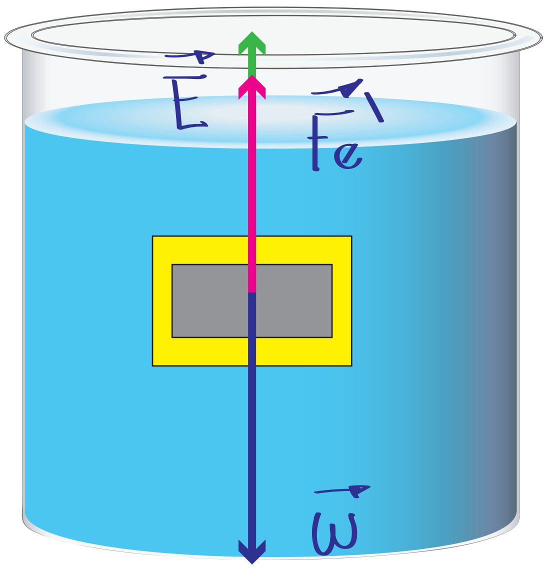
$$\uparrow \sum F_y = 0$$

$$F_e - W = 0$$

$$F_e = W$$

$$F_e = W_{Al} + W_{Au} \quad \ldots\ldots \quad ec\ 1$$

b)



$$\uparrow \sum F_y = 0$$

$$E + F_e' - W = 0$$

$$E = W - F_e'$$

$$E = (W_{Al} + W_{Au}) - F_e'$$

$$E = F_e - F_e'$$

$$W_s = F_e - F_e'$$

$$m_s g = F_e - F_e'$$

Sabemos

$$\rho = \frac{m}{V} \implies m = \rho V \implies V = \frac{m}{\rho}$$

Remplazando

$$\rho_{H_2O} V_s g = F_e - F_e' \quad \ldots \text{ ec } 2$$

Tenemos

$$V_s g = (V_{Al} + V_{Au}) g$$

$$V_s g = V_{Al} g + V_{Au} g$$

$$V_s g = \frac{m_{Al}}{\rho_{Al}} g + \frac{m_{Au}}{\rho_{Au}} g$$

$$V_s g = \frac{W_{Al}}{\rho_{Al}} + \frac{W_{Al}}{\rho_{Au}}$$

Remplazando en 2

$$\rho_{H_2O} V_s g = F_e - F_e'$$

$$\rho_{H_2O} \left(\frac{W_{Al}}{\rho_{Al}} + \frac{W_{Au}}{\rho_{Au}} \right) = F_e - F_e'$$

Utilizando ec 1

$$F_e = W_{Al} + W_{AU}$$

$$W_{Al} = F_e - W_{AU}$$

Remplazando

$$\rho_{H_2O}\left(\frac{F_e - W_{AU}}{\rho_{Al}} + \frac{W_{AU}}{\rho_{AU}}\right) = F_e - F_e'$$

$$\frac{\rho_{H_2O}}{\rho_{Al}} F_e - \frac{\rho_{H_2O}}{\rho_{Al}} W_{AU} + \frac{\rho_{H_2O}}{\rho_{AU}} W_{AU} = F_e - F_e'$$

$$W_{AU}\, \rho_{H_2O}\left(\frac{1}{\rho_{AU}} - \frac{1}{\rho_{Al}}\right) = F_e - F_e' - \frac{\rho_{H_2O}}{\rho_{Al}} F_e$$

$$W_{AU}\, \rho_{H_2O}\left(\frac{1}{\rho_{AU}} - \frac{1}{\rho_{Al}}\right) = \left(1 - \frac{\rho_{H_2O}}{\rho_{Al}}\right) F_e - F_e'$$

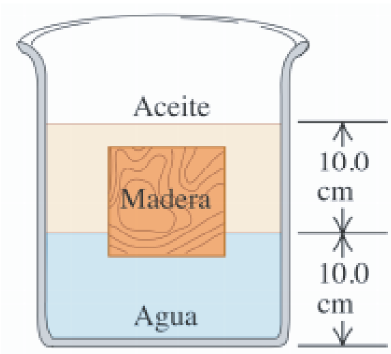
$$W_{AU} = \frac{\left(1 - \frac{\rho_{H_2O}}{\rho_{Al}}\right) F_e - F_e'}{\rho_{H_2O}\left(\frac{1}{\rho_{AU}} - \frac{1}{\rho_{Al}}\right)}$$

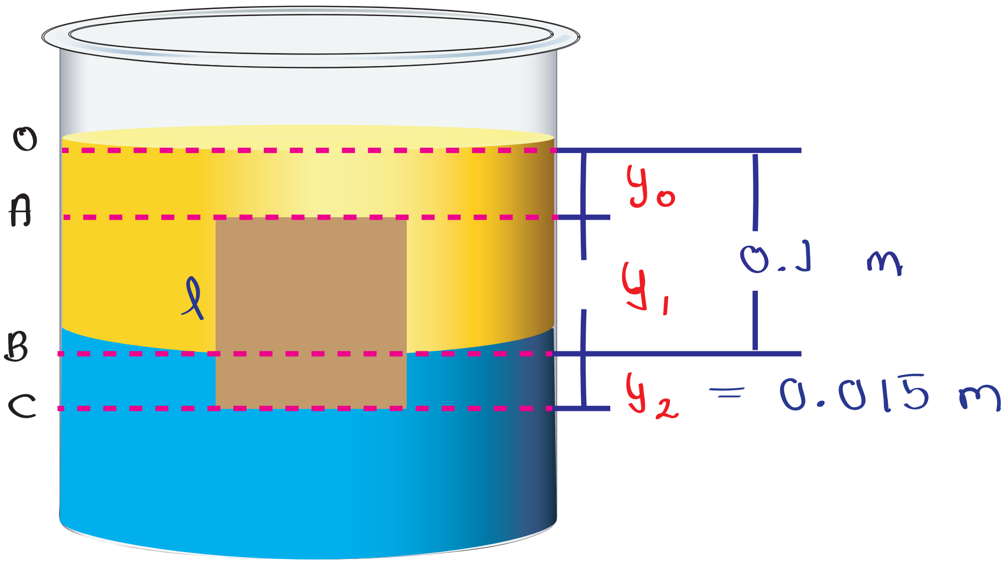
$$W_{AU} = \frac{\left(1 - \frac{1 \times \cancel{10^3}}{2.7 \times \cancel{10^3}}\right) 45 - 39}{1 \times \cancel{10^3} \left(\frac{1}{19.3 \times \cancel{10^3}} - \frac{1}{2.7 \times \cancel{10^3}} \right)}$$

$$W_{AU} = 33.5\ [N]$$

9. Un bloque cubico de madera de $10{,}0cm$ por lado flota en la interfaz entre aceite y agua con su superficie inferior $1{,}50cm$ bajo la interfaz. La densidad del aceite es de $790kg/m^3$ a) ¿Qué presión manométrica hay en la superficie de arriba del bloque? b) ¿Y en la cara inferior? c) ¿Qué masa y densidad tiene el bloque?

Resp: $116Pa$ $921Pa$ $0{,}822kg$ $822kg/m^3$





Tenemos

$$0.1 = y_1 + y_0$$

$$l = y_1 + y_2$$

$$y_1 = l - y_2$$

$$y_1 = 0.1 - 0.015$$

$$y_1 = 0.085\ [m]$$

Remplazando

$$0.1 = y_1 + y_0$$

$$y_0 = 0.1 - 0.085$$

$$y_0 = 0.015\ [m]$$

a)

$$P = P_0 + \rho g h$$

$$\Delta P_M = P - P_0$$

Tramo $0 \rightarrow A$

$$P_A = P_0 + \rho_a g y_0$$

$$P_A - P_0 = \rho_a g y_0$$

$$\Delta P_{M_A} = 790\,(9.8)\,(0.015)$$

$$\Delta P_{M_A} = 116.13\ [\text{Pascal}]$$

b) $O \rightarrow B$

$$P_B = P_o + \rho_a g (0.1)$$

$B \rightarrow C$

$$P_C = P_B + \rho_{H_2O} g y_2$$

Remplazando

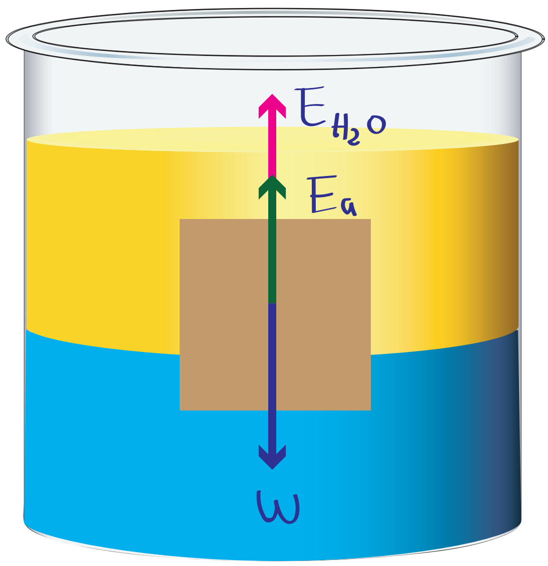
$$P_C = P_o + \rho_a g (0.1) + \rho_{H_2O} g y_2$$

$$P_C - P_o = \left[\rho_a (0.1) + \rho_{H_2O} (0.015)\right] g$$

$$\Delta P_{M_C} = \left[790 (0.1) + 1000 (0.015)\right] 9.8$$

$$\Delta P_{M_C} = 921.2 \text{ [Pascal]}$$

c)



$$\uparrow \sum F_y = 0$$

$$E_{H_2O} + E_a - W = 0$$

$$E_{H_2O} + E_a = W$$

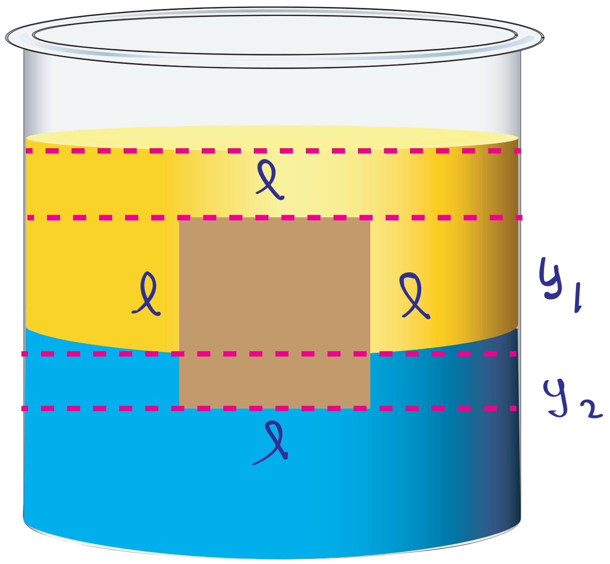
$$W_{s_{H_2O}} + W_{s_a} = W$$

$$m_{s_{H_2O}} \cancel{g} + m_{s_a} \cancel{g} = m \cancel{g}$$

$$\rho_{H_2O} V_{s_{H_2O}} + \rho_a V_{s_a} = m$$

$$m = \rho_{H_2O} V_{s_{H_2O}} + \rho_a V_{s_a}$$

Sabemos



$$V_{s_{H_2O}} = \ell^2 y_2 = (0.1)^2 (0.015)$$

$$V_{s_{H_2O}} = 1.5 \times 10^{-4} \; [m^3]$$

$$V_{sa} = \ell^2 y_1 = (0.1)^2 (0.085)$$

$$V_{sa} = 8.5 \times 10^{-4} \, [m^3]$$

Remplazando

$$m = \rho_{H_2O} V_{sH_2O} + \rho_a V_{sa}$$

$$m = 1 \times 10^3 (1.5 \times 10^{-4}) + 790 (8.5 \times 10^{-4})$$

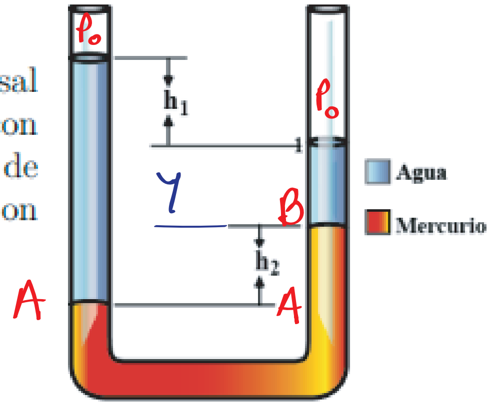
$$m = 0.822 \, [Kg]$$

$$\rho = \frac{m}{V} = \frac{0.822}{0.1^3}$$

$$\rho = 822 \left[\frac{Kg}{m^3} \right]$$

11. Un tubo en forma de U de un área de sección transversal uniforme abierta a la atmosfera, se llena parcial mente con mercurio y agua en ambos brazos. Si la configuración de equilibrio del tubo es como se muestra en la figura. Con $h_2 = 1{,}00 cm$, ¿Determine el valor de h_1?

Resp: $12{,}6 cm$



Datos

$$\rho_{H_2O} = 1 \ g/cm^3$$

$$\rho_{Hg} = 13.6 \ g/cm^3$$

$$h_2 = 1 \ cm$$

$$P = P_o + \rho g h$$

Lado Izquierdo

$$P_A = P_o + \rho_{H_2O}\, g\, H$$

$$P_A = P_o + \rho_{H_2O}\, g\, (h_1 + y + h_2) \ \ldots ec1$$

La Derecho

$$P_B = P_o + \rho_{H_2O}\, g\, y$$

$$P_A = P_B + \rho_{Hg}\, g\, h_2$$

$$P_A = P_0 + \rho_{H_2O}\, g\, y + \rho_{Hg}\, g\, h_2 \quad \ldots ec2$$

Igualando ec 1 y 2

$$\cancel{P_0} + \rho_{H_2O}\, g\,(h_1 + y + h_2) = \cancel{P_0} + \rho_{H_2O}\, g\, y + \rho_{Hg}\, g\, h_2$$

$$\rho_{H_2O}\,\cancel{g}\, h_1 + \cancel{\rho_{H_2O}\, g\, y} + \rho_{H_2O}\,\cancel{g}\, h_2 = \cancel{\rho_{H_2O}\, g\, y} + \rho_{Hg}\,\cancel{g}\, h_2$$

$$h_1 = \frac{(\rho_{Hg} - \rho_{H_2O})\, h_2}{\rho_{H_2O}}$$

$$h_1 = \frac{(13.6 - 1)\ 1}{1}$$

$$h_1 = 12.6\ [cm]$$